

## ***Interactive comment on “AMPERE Polar Cap Boundaries” by Angeline G. Burrell et al.***

### **Anonymous Referee #2**

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This paper looks at the open closed magnetic field line boundaries (OCB) of Earth's magnetosphere. It provides a new set of OCBs, derived from Active Magnetosphere and Planetary Electrodynamics Response Experiment (AMPERE) Region 1 and Region 2 (R1/R2) field aligned current boundaries, which are then compared to older measurements of the OCB from the Defense Meteorological Satellite Programme's (DMSP) electron flux measurements obtained with the Special Sensor J (SSJ), as well as measurements obtained by the Imager for Magnetopause-to-Aurora Global Exploration (IMAGE) satellite. A parameterisation is then performed on the AMPERE R1/R2 boundary measurements, which are initially only taken at dusk & dawn, to obtain an oval fit for the OCB offset as a function of magnetic local time dependence. The measurements and comparison of different datasets show that there is little offset (generally within  $\sim 1$  degree) between the R1/R2 boundary measurements and the DMSP OCB measurements.

C1

General comments: The comparisons in this paper provide a basis for a new adaptive framework for analysing data in the future and the large-scale analysis provides confidence and validation for this method. Overall, this adds to a large body of existing science and thus will be relevant to the research community. I believe that this paper is worthy of publication, but some clarification is necessary first (with some additional analysis being potentially necessary) and some further discussion of the results would be highly desirable (listed below).

Specific comments (Major):

- Section 2.1: How do you identify boundaries using AMPERE? You talk about AMPERE but not how the boundaries are specifically identified, but you have already mentioned this in passing. In the next section, you go straight into the OCB determination and it would be good to have the same here for consistency.

- Section 2.2, approx. L 25+: What about the fact that the polar cap may move towards nightside? I.e. dusk-dawn measurements may not always be comparable with each other and this may create some inconsistencies. Is this going to add an error to your estimations? This is something which is mentioned later, but I think this needs to be addressed straight away.

- Section 3, L 11: Your peak-to-peak magnitude will somewhat depend on the latitude and the offset between the two peaks also. Is this considered? If not, you may have to normalise the peak-to-peak ratio. E.g. for a circle closer to the pole, the points will be closer spaced than further towards the equator, so more points will lie in each AMPERE MLT than closer to the equator, which could skew the results if not taken into account.

- Section 3, L 16: What is the justification for the 10 min timescale? Is this not too long? For example, Substorm contractions of the OCB for example, can occur on timescales shorter than this.

C2

- Figure 1: Can you plot on the median/quartiles of the DMSP boundaries also? There are a lot of overlapping points, so it's hard to see.
- Page 8, L 2: Why is one number negative and one positive? Is this due to inter-hemispheric differences? In general, it would add a lot if you could add a discussion of interhemispheric differences and asymmetries in the context of existing research.
- Page 9, L 6: Why fit an ellipse now? Why not fit an ellipse straight away? I.e why aren't you fitting one to the AMPERE data?
- Page 9, L 11: Is there a version number that goes with this software?
- Page 10, L 11: Again, is the 10 min timescale not too long?

Technical corrections (Minor):

- Abstract L 15: insert "the Imager for " before "Magnetopause-to-Aurora Global Exploration".
- Section 1, L 2: add "and the solar wind" after "between the ionosphere and magnetosphere".
- Page 9, L 11: Why is there a dash after the Jones reference?
- Page 10, L 11: Which OCBs? There is a lot mentioning of different OCBs in the previous sentences, so it's unclear which one you mean in this sentence.

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